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AUTHOR McNergney, Robert
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ABSTRACT

Aptitude treatment interaction (ATI), as applied to education, measures the interaction of personality factors and experimentally manipulated teaching strategies. ATI research has had dissappointingly inconclusive results so far, but proponents argue that this has been due to imprecise methods, which can be rectified. They believe that intervention strategies can remedy learning deficiencies, circumvent a learning deficiency by presenting information in a highly accessible manner, and capitalize on specific learning strengths. One way this is possible is by taking into consideration the cognitive development level of the learner. This is done by providing highly structured learning environments for students at a low conceptual level, and very little structure with an emphasis on choice and decision making on the part of the students for learners at high conceptual levels. Proponents of ATI argue that it broadens competency based teacher education by stressing the importance of the individual and the environment, and by varying the content, sequence, and practice variables of teacher education. (CD)

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Applying An Aptitude-Treatment Interaction Approach To Competency Based Teacher Education

Robert McNergney

University of Minnesota

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The purpose of this paper is to suggest one strategy for the investigation of the differential effects of person and environment upon students' learning behaviors in programs of competency based teacher education. A differential effects approach rejects the assumption that one method of education is appropriate for all persons. It is concerned rather with the questions of what training experiences are appropriate for what persons. If different persons do in fact behave differently in various teacher education environments, then it may be possible to construct principles which more fully explain the processes of teacher education and ultimately use these principles to improve programs.

A common claim of competency based teacher education is that a student will be able to work through programs that are personalized and individually suited to his/her needs. Underlying this claim is the assumption that one particular training environment is neither appropriate nor desirable for all training objectives and with all persons. Houston and Howsam (1972) state that individualization of instruction as a primary characteristic of competency based teacher education programs cannot be overemphasized. Students are encouraged to select objectives and pace their own work. According to Houston and Howsam, effective programs are designed to be directly responsive to the needs and objectives of each learner.

> "Effective programs employ an extensive array of instructional strategies. Modules provide for at least two, and often more, alternatives (such as a teacher presentation, a slide-tape presentation, or a computer-based program), from which the learner makes a choice. Individualization does not imply, however, that every activity must be

> pursued in isolation. Some are; others are done with buddies, with small groups, in seminar-sized groups, in classes, or even in very large groups. Competency based instruction does, indeed, provide a veritable smorgasbord of learning opportunities." (1972 , p. 9)

If students are to partake of this "veritable smorgasbord," is it valid to assume that dining on an eclectic assortment of training activities and methods will serve all kinds of students, and if left to choice, will students select those experiences which are most likely to enhance their development? It is possible that persons of varying aptitude and different educational treatments may combine to produce differential effects on behavior, i.e., interactions between persons and environments may exist.

Persons proposing to individualize and personalize competency based programs, therefore, are forced to contend with two problems. The first problem to be confronted is that of investigating the effects of different environments on different persons, or looking for interactions. If interactions do indeed exist then the second problem is one of matching appropriate environments to individual learners in order to yield persons who are satisfied with their education and who are able to perform to the fullest of their abilities. These concerns are not unique to competency based teacher education, they are the bread and butter of aptitude-treatment interaction research.

The idea that different persons and different treatments may interact to produce different results is not new. Hunt (1971) cites Lewin's (1935) statement of behavior being a function of both person and environment, B = (f)P,E, as the classic interaction statement. The current interest in education rgarding aptitude-treatment interaction, however,

is generally traced to Cronbach. In his now familiar (1957) presidential address to the American Psychological Association, he called for the union of correlational and experimental psychology to form a discipline concerned with the study of individual differences and various treatment procedures and the interaction of these organismic and treatment variables.

In their review of the literature, Berliner and Cahen (1973) draw attention to the historical background of aptitude-treatment interaction thought and the diverse areas which have contributed to this body of research. They note that as early as 1887, Charcot classified persons according to "audile" and "visile" types and recommended capitalizing on their preferred learning modes. They found examples of aptitude-treatment interaction type research in the field of special education, anthropology, pharmacology, and medicine. They note diversity not only in disciplinary areas but in terminology as well. The term aptitude-treatment interaction (ATI) has been used to denote this area of research (Cronbach and Snow, 1969). Tobias (1969), however, uses the term attribute-treatement interaction. Berliner and Cahen prefer to use trait-treatment interaction (TTI), believing the term "trait" to be less restrictive than either "aptitude" or "attribute". Regardless of the term used, the concept refers to measuring the interactive effects of personological characteristics and experimental treatments on behavioral outcomes.

The work of Salomon (1971) provides additional information on the differential effects of person and environment as applied to education. He sees ATI as serving two purposes: improving instruction by considering individual differences and developing better explanatory principles concerning the nature of instruction. In an extension of Snow's (1970) work,

Salomon outlines three models of ATI which suggest direction for study.

Salomon refers to the first heuristic as the remedial model. The purpose of this model is to overcome learner definciencies in order to facilitate progress. Where the remedial model is intended to improve deficiencies, the second, or compensatory model, leaves these deficiencies untouched. The compensatory approach attempts to circumvent deficiencies by supplying presentation modes which the learner cannot provide for himself. The third, or preferential model, attempts to capitalize on the student's existing capabilities by designing treatments which are directed toward the person's preferred style of learning. The models described by Salomon offer direction for the design of treatments, the selection of aptitudes, and the formulation of predicted outcomes for person-environment studies.

While it is possible that ATI thought may be usefully applied to education, this area of research has not been without its share of disappointing results and various conceptual and methodological problems. Bracht and Glass (1968) and Bracht (1970) issued a pessimistic for cast for the promise of ATI research. Bracht's (1970) analysis of ninety research studies identified only five with disordinal interactions.[1] He concluded that the meager pay-off of ATI research raises serious doubts as to its efficacy. Cronbach and Snow (1969) provided additional insight into some of the problem areas in this type of research. They

[1]Kerlinger and Pedhazur (1973) note the Lindquist (1953) and Lubin (1961) definitions of two kinds of significant interaction effects. The ordinal interaction is one where the"'rank order of the treatments is constant,'". A disordinal interaction is one where the "'rank order of the treatments changes'".

suggested directions for strengthening ATI by eliminating weaknesses present in the research, such as: the use of vague, atheoretical aptitudes and haphazard treatments, incorrect reporting of data, improper use of gain scores, the adverse effects of "blocking" aptitude measures, the reliance on significance testing at the expense of descriptive presentation of results, etc. Despite the previous and existing problems of ATI, Cronbach and Snow supported this approach with the belief that to "abondon the aptitude-treatment interaction model is to assume that there is only one path toward educational development, and that individual differences have no implication save the fatalistic one, of telling the educator that some pupils will advance more rapdily than others no matter what he does." (p. 193).

In response to the concern over the past failures of ATI research to yield statistically significant interactions, Hunt and Sullivan (1974) propose that differential effects be evaluated by three kinds of criteria: theoretical, empirical and personal. A theoretical evaluation would demand that person-environment interaction combinations be formulated and evaluated on the basis of logical, consistent, theoretical principles. An empirical approach would follow the more strict definition of evaluation, i.e., interactions and the variance contributed by the person and the environment would be determined statistically. An finally, a personal evaluation would ask that person-environment matching meet the criterion of a person's intuitive reasonableness in light of his/her past experiences. As Hunt and Sullivan point out, each of these criteria, being more or less acceptable to psychologists and educational practitioners,

offers an avenue for collecting evidence on the effects of person and environment on behavior.

The theoretical approach which is of interest in this paper is presented by Harvey, Hunt and Schroder (1961) and extended by Hunt (1971). Their Conceptual Systems theory sets forth principles of person-environment matching which are particularly applicable to the teaching-learning process. This developmental personality theory describes the person in terms of his/her conceptual level (CL) and the environment in terms of the degree of structure.

The theoretical construct of CL is assumed to vary along two dimensions, i.e., a person's self-other relationships and his/her cognitive complexity. Those persons who are said to possess a high CL are characterized by their cognitive complexity and ability to think abstractly. They are typically capable of generating new concepts and viewing the world from a variety of different perspectives, while possessing their own independent, internal set of standards and the abilities to cope with stress and ambiguity. These persons would be expected to prefer and profit more from a learning environment of low structure or be unaffected by the degree of structure. Low conceptual level or cognitively concrete persons on the other hand, are characterized by their independence on external standards, categorical thinking and low tolerance of stress and ambiguity. These persons would be expected to prefer and profit most from an environment of high structure. Conceptual Systems theory formulates a generally inverse relationship between CL and degree of structure of the educational environment. Low CL

persons would predictably benefit from and prefer high structure. High CL persons would be expected to profit more from and prefer low structure, or be less affected by the degree of structure of the environment.

In a study which used the conceptual level matching model as a base, Tomlinson (1969) examined the effects of low, moderate, and high levels of structure on students' concept learning abilities. Low structure was defined by presentation of examples followed later by a rule. Moderate structure was defined by presentation of examples followed immediately by a rule. And high structure was defined by presentation of a rule followed by examples. The principle the students were to learn was Festinger's concept of "cognitive dissonance". Students' concept learning abilities were measured on the basis of three criteria: definition of the concept, recall of examples and production of new examples. High CL students performed significantly better than low CL students in low structure, while a decrement in performance of high CL students in high structure was indicated.

Another often cited example of the differential effects of conceptual level and structure of the educational environment is presented by McLachlan (1969). He studied the interaction of student conceptual level and discovery (low structure) learning versus a lecture (high structure) approach. Equal groups of high and low CL students were matched on ability and placed in each of two treatments. Students under both conditions were presented with same materials, i.e., a slide of Picasso's Guernica and a series of component parts of the painting on separate slides. Students in the high structure treatment were presented a short lecture on

the meaning of the component slides and students in the low structure treatment viewed each slide but were directed to determine for themselves the meaning of the painting. The results showed low CL students performing significantly better with high structure than with low structure. No differences were noted for the high CL students.

While research in Conceptual Systems theory has developed the concept of CL as a relatively precise measure of the person, the same cannot be said for the concept of the degree of structure of the environment. The need to strengthen the idea of the degree of structure of the environment is pointed out by Hunt and Sullivan:

> "If the CL matching model is to be educationally effective, the ideas of degree of structure of the environment must be translatable into specific procedures. This is obviously a central point in implementation, and ... it is the weakest link in the model." (1974, p. 264).

In order to apply the conceptual level matching model to a teacher education program it is essential, therefore, to begin by defining the degree of structure of the educational environment. Determining the degree of structure is dependent upon identifying the environmental effects which may influence the behavior of prospective teachers. An inductive approach to such a monumental task might well generate list upon list ad infintum. One more practical approach is to outline a set of general concepts and work toward more precise definitions of these comprehensive areas of programmatic structure. The intent of this paper is neither to exhaust all possible environmental vairables nor to present a simplistic formula for gauging students' learning environments. Rather, the purpose is to begin to construct a schema from a practical point of view, i.e., spelling out some variables which separately or in

combinations may be feasibly manipulated, examined, and refined in relationship to student conceptual level during the course of a teacher education program.

Traditionally teacher education has controlled in varying degrees, the following four elements of a student's program: what a student learns, how a student learns, where a student learns; when a student learns. These components of the educational environment form the foundation upon which the following dimensions of structure are based.

What a student is expected to learn may be referred to as the program content. This content is potentially diverse and is reflected in the skills, attitudes, knowledges or competencies which a program expects a student to possess at the conclusion of his/her education. Joyce and Weil's (1972) models of teaching illustrate the breadth of the range of philosophic sources which may serve as a basis for the selection of a program's content. Students may be expected to demonstrate their knowledge of content through their abilities to understand, organize and implement teaching models. These models may be used for different purposes, e.g., to enhance children's own unique, personal development, their social growth or their attainment of basic subject matter content.

In order for prospective teachers to establish environments which foster growth experiences for children, they are usually required to demonstrate competence in the ability to understand diverse content material. They must learn how to utilize skills and knowledges which are relevant to one particular model as well as skills and knowledges which are common to several models. The synectics model, which Joyce and Weil

categorize as a model intended to foster personal growth, requires the teacher to possess the abilities to understand and use a variety of metaphors in order to stimulate creativity in children. The developmental model, a member of Joyce and Weil's information-processing family requires the teacher to exhibit his/her ability to organize an environment according to Piagetian stages of child development. While the foci of the two models are different, both require that a teacher possess the knowledge which will enable him/her to react to children in a free and accepting manner.

There is a vast amount of content which prospective teachers may be expected to learn. Accepting the idea that all teachers must be knowledgeable in some minimal portion of this massive dimension of a prospective teacher's learning environment does not preclude the possibility that some program content may be adjusted to fit individual students. It is conceiveable that all teachers may not need to be exposed to the same content in order to be effective with their pupils.

How a student works toward mastery of program content, or the preparatory experiences in which he/she engages, forms another dimension of the educational environment. These experiences may be referred to as learning activities. Programs utilize various learning activities to enable a student's attainment of their goals. For example, a student may study the theoretical basis of a particular teaching strategy by reading about the supporting theory. As an alternative or as a supplement to reading, a student may attend lectures and/or discussion groups on the particular strategy under consideration. Having been exposed to theory, a

student may study the practical application of theory by observing and critically analyzing video tapes, audiotapes, and/or by observing live classroom episodes of the particular strategy. And finally, student competence in implementing a teaching strategy and its component skills may be demonstrated by peer teaching, microteaching and/or applying the approach in a typical school classroom situation. These, to mention but a few, are possible learning activities which may be varied for individual students during the course of a program. Just as learning activities themselves vary, so too may the location in which students encounter these activities.

The location, or where a student learns, may be referred to as the instructional setting. This one dimension may be thought of as subsuming three general categori s. Students may study teaching and learning: (1) on campus, (2) in various field settings, (3) in combinations of both campus and field experience. Within the general areas of campus and field instruction there are an almost limitless variety of settings which may be provided for prospective teachers. A student may work on campus in a self-instructional lab or attend classroom lectures. The student may also spend time in a self-contained, tightly controlled classroom in a rural community. A different student may devote part of his/her time working with a team of teachers in a free-wheeling, open atmosphere in the inner-city. The variance among instructional settings is potentially great, limited only by logistical and political concerns of providing these environments and the degree of precision used to define them.

When a student learns may be categorized according to two dimensions of the educational environment: learning rate and learning sequence. In a criterion-referenced program a student is competing with a set of program goals which are deemed to be indicators of competence. Theoretically, each student may work at his/her own rate in order to meet these program requirements. Some students may spend most of their time studying teaching-learning theory. Others may practice instructional skills in micro or mini teaching episodes. Still other students may devote most of their time to observing and teaching whole classes of children. There is the potential in competency based teacher education programs to adjust the amount of time spent on various sources of content, the time devoted to various learning activities, and the time spent in different instructional settings, in order to fit individual learning rates.

The complement of learning rate, i.e., learning sequence, may refer to the sequence of each dimension of environmental structure. The sequence of content, the sequence of learning activities, and/or the sequence of instructional settings may be manipulated and studied during the course of a program. Some students may benefit from learning activities geared toward the in-depth study of teaching-learning theories prior to working with children. Other students may benefit more from direct involvement with children before tackling the theory. Critiquing videotapes of teaching episodes before a microteaching session may benefit some students while having little or no effect on others. Studying the work of Carl Rogers prior to that of B. F. Skinner, or vice versa, may affect the way some students view teaching and learning and thus be reflected in their performance.

A teacher education program may exercise varying degrees of control over the content, learning activities, the instructional settings, the rate at which students progress, and the sequence of a student's program. In order to form person-environment combinations which are relevant to Conceptual Systems theory, it is not only necessary to begin to identify the dimensions of structure which may influence a students' learning, but to establish a procedure for distinguishing between higher and lower degrees of environmental structure.

One method which begins to differentiate higher and lower degrees of structure is presented by Joyce and Weil (1972). They characterize the degree of structure of each of sixteen models of teaching according to the amount of negotiation between teacher and learner. Models in which the focus and flow of activity are predominantly controlled by the teacher are said to be high structure environments. Models which allow the learner the primary responsibility for determing the course of events are characterized as low structure environments. Those models in which decisions are negotiated or shared between teacher and learner are labeled as moderate in structure. Table I illustrates how these procedures of decision-making and the above dimensions of structure might be coordinated with a student's CL and applied to a teacher education program in order to examine differential effects.

Insert Table I about here

Table I

Relation Between Conceptual Level
and Optimal Environment

Person	Environment
Low Conceptual Level	High Degree of Structure (Fewer options within and among the following dimensions. Locus of control for deciding among these options is with the program) program content learning activities instructional setting learning rate learning sequence
High Conceptual Level	Low Degree of Structure (More options within and amng the following dimensions. Locus of control for deciding among these options is with the student). program content learning activities instructional setting learning rate learning sequence

As Table I indicates, persons varying in conceptual level would be matched with their optimal learning environments. High conceptual level students would p' :y a greater role in making decisions about the content, the learning activities, the instructional setting, the learning rate and the sequence of their work. Low conceptual level students, on the other hand, would be given more direction by the program to help them determine program patterns which would fit their learning style.

There are a number of problems involved in applying ATI paradigms in general, and the CL matching model in particular, to competency based teacher education. CL is not a magic variable which provides all the necessary information about how prospective teachers will most effectively learn. Conceptual level, or any other single variable, offers no quick, easy solution to the complexities of individualizing and personalizing instruction in a competency based program. Hunt (1971) mentions other person variables or "accessability channels" which might be taken into consideration when examining the effects of person and environment on behavior. The CL matching model is only one possible approach to the study of differential effects.

Hunt (1973) addressed many of the criticisms of an ATI or differential effects approach to learning. He noted the processes of labeling and matching persons to training environments raises serious ethical concerns. Some may believe that it is inequitable and inherently dangerous to type persons according to aptitude and place them in treatments which vary along certain dimensions. It is conceivable that matching models could be used, or abused in such a way as to force a learner along a rigid track,

possible stifling his/her desire to learn. Conceptual Systems theory, however, is intended to maximize growth not arrest it. The theory postulates that a person's cognitive growth is developmental in nature and is not indefinitely fixed at one point on the continuum. Persons are believed to progress in cognitive development by functioning in environments which are slightly less structured (more complex) than their ideally matched environments. This optimal mismatch of person and environment is believed to be a necessary requirement for assuring continued cognitive development. When there is reason to believe that no one learning environment is best for all people or that totally incongruous combinations of persons and environments may impede growth, then the process of matching persons with different environments may indeed be the only ethical approach.

There is general criticism that competency based teacher education places an inordinate amount of emphasis on behavior, simultaneously de-emphasizing the importance of the student as a human being. At first glance the process of matching person and environment to produce desired behavior may be viewed as further dehumanizing teacher education by adding to the already mechanistic aspects of CBTE. The CL matching model and other ATI paradigms are concerned with behavior, but behavior as produced by individual differences in combination with various learning treatments. Viewing CBTE with an ATI perspective streatches the concept of competence beyond a heavily behavioristic product orientation by reemphasizing the importance of person and environment as they relate to educational outcomes.

Applying the CL matching model or different ATI models might encourage teacher education programs to abandon the search for the one best way to prepare teachers. Instead, efforts would be concentrated on finding out how a program might best be organized in order to meet the needs of its individual participants. That kind of approach is the essence of personalizing and individualizing education.

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